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Prevalence of anaemia among blood donors in Sokoto, North Western, Nigeria

Erhabor O.[1, *], Imrana S.[1], Buhari H.[1], Abubakar W.[1], Abdulrahaman Y.[1], Isaac I. Z.[1], Ahmed M.[1], Yeldu M. H.[2], Dallatu M. K.[2], Mainasara A.[2]

[1]Faculty of Medical Laboratory Science, Department of Haematology, Usmanu Danfodiyo University Sokoto, Nigeria
[2]Department of Clinical Biochemistry, Usmanu Danfodiyo University Sokoto, Nigeria

Email address
n_osaro@yahoo.com (Erhabor O.)

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Abstract
Background: There is paucity of information on the prevalence of anaemia among blood donors in Sokoto, North Western, Nigeria. The present study was, therefore, designed to investigate the prevalence of anaemia and its associated socio-demographic factors among blood donors in Sokoto, North Western, Nigeria using a combination of haemoglobin, packed cell volume and red cell indices parameters. One hundred and fifty consecutively recruited whole blood donors, comprising of 148 (98.7%) family replacement donors and 2 (1.33%) voluntary non-remunerated donors aged 18-60 years and mean age 39 ± 21 years constituted the subjects for this study. Five haematological parameters (haemoglobin, packed cell volume, mean cell haemoglobin, mean cell volume and mean cell haemoglobin concentration) was assessed using the Mythic 22 CT fully automated haematology analyser (Orphee SA, Switzerland). The prevalence of anaemia alone (haemoglobin <11.0 g/dL) was 16%. The mean haemoglobin was higher among voluntary non-remunerated donors compared to family replacement donors (13.8 ± 1.69 versus 13.5 ± 1.2). Haemoglobin, packed cell volume and MCV was significantly higher among men compared to women (14.2 ± 2.0, 44± 4.0 and 85±10) versus (12.35 ± 2.5, 42 ± 3.0 and 66±54) respectively (p=0.01). Haemoglobin and mean cell volume was higher among civil servants compared to farmers and students (13.2 ± 2.9 and 92.5 ± 32), (12.5 ± 21 and 78.02 ±49.10) and (13.21±2.5 and 87.8±50.5) respectively (p=0.03). Anaemia is prevalent among blood donors in Sokoto, North Western, Nigeria. There is need to review the screening tests for the selection of blood donors and include haemoglobin measurement in the donor screening menu as well as provide iron supplementation for regular blood donors.

1. Introduction

Anaemia is a global public health problem [1]. Screening for anaemia is essential for blood donation to protect the donors and optimize the aim of red cell transfusion in the recipient. Haemoglobin levels should be above 12.5 g/dL and 13.0 g/dL and haematocrit concentrations above 38% and 39% in women and men respectively [2]. One of the commonest reasons for deferral of prospective blood donors is anaemia

[3-4]. Iron deficiency is the commonest cause of anaemia among blood donors [5-6]. The most significant cause of iron-deficiency anaemia in developing countries is parasitic worms (hookworms, whipworms and roundworms). Worms cause intestinal bleeding, which is not always noticeable in faeces, and is especially damaging to growing children [7]. Malaria and vitamin A deficiency contribute to anaemia in most underdeveloped countries [8] . In women over 50 years old, the most common cause of iron-deficiency anaemia is chronic gastrointestinal bleeding from non-parasitic causes, such as gastric ulcers, duodenal ulcers or gastrointestinal cancers. The most common causes of anaemia in Nigeria include; nutritional deficiencies of iron and folate, parasitic diseases such as malaria and hookworm, haemoglobinopathies such as sickle cell disease, malnutrition associated with reduced dietary intakes of iron containing diets and recently human immunodeficiency virus infection [9-10]. In the absence of an optimized blood transfusion service in most settings in sub Saharan Africa to regulate the practice of blood donation, the safety of blood supplies and that of donor as well as the recipient becomes a source of concern. Assessing blood donors for their haemoglobin (Hb) is a worldwide screening requirement against inappropriate donation [11]. Haemoglobin estimation is the criteria used in most part of the world in the determination of whether prospective donors, are fit for donation and to rule out the presence of anaemia [12].

There is paucity of data on the prevalence of anaemia among donors in the Sokoto, North Western Nigeria. The present study was, therefore, designed to determine the prevalence of anaemia and its associated socio-demographic factor using a combination of haemoglobin, packed cell volume, Mean Cell Volume (MCV), Mean Cell Haemoglobin (MCH) and Mean Cell Haemoglobin Concentration (MCHC).

2. Materials and Method

2.1. Study Area

Usmanu Danfodiyo University Teaching Hospital Sokoto is tertiary health facility located in Sokoto State at the extreme Northwest of Nigeria between longitude 05^0 and$11^0$to 13^0 and 03^0 East and between latitude 13^0 and 00^0 to $13^0$and 06^0 North. The state shares border with the Republic of Niger to the North, Kebbi State to the West and Southeast and Zamfara state to the East. The state cover land area of about $60.33km_2$. Report from the 2007 National population commission indicated that the state had a population of 3.6 million [13]. The indigenous inhabitants of the area are the Hausa, and Fulani. Other ethnic group resident in the area includes Igbo, Yoruba, Ebira, and Igala. Hausa is the commonly spoken language. Traders form the greater percentage of the population, while the rest are civil servants, farmers, artisans and of other occupation.

2.2. Study Population

One hundred and fifty apparently healthy consecutively-recruited blood donors visiting the blood bank in Usmanu Danfodiyo University Teaching Hospital for blood donation purpose constituted the subjects for this case study.

2.3. Inclusion Criteria

All consecutively - recruited, consenting blood donors aged 18-60 years, resident in Sokoto, without any history of long- term medication use, illness, recent blood transfusion in the last 4 months and menstruation (female) visiting the Blood Transfusion Department of Usmanu Danfodiyo University Teaching Hospital Sokoto for blood donation purpose were recruited into the study.

2.4. Exclusion Criteria

All Blood donors visiting the Transfusion Laboratory of Usmanu Danfodiyo University Sokoto for blood donation purpose who did not meet the inclusion criteria were excluded from the study. Ethical approval was sought from the ethical committee of Usmanu Danfodiyo University Sokoto, Nigeria.

2.5. Statistics

Statistical analysis were conducted using SPSS (version 18) software. Comparisons between populations were made using the Student's t-test for parametric data and the Mann-Whitney test for non-parametric data. A p-value of < 0.05 denoted a statistically significant difference in all statistical comparisons.

2.6. Sampling and Methods

About 3 millilitres of whole blood were collected using monovette vacutainer syringe into EDTA anticoagulated tube to be used for the determination of Full Blood Count (FBC). The full blood count was carried out using Mythic 22 CT fully automated haematology analyser (Orphee SA, Switzerland). The analyser is a fit for purpose fully automated 22-parameters haematology analyser with associated low reagent consumption and less maintenance. It is based on the impedance technology for cell counting.

3. Result

The prevalence of anaemia alone (haemoglobin <11.0 g/dL) was 16%. The mean haemoglobin and packed cell volume was higher among voluntary non-remunerated donors compared to family replacement donors (13.8 ± 1.69 and 45±3.0 versus 13.5 ± 1.2 and 43.5±2.0) respectively, the difference however was not statistically significant. Table 1 show the mean values haematological parameters based on donor type. Haemoglobin, packed cell volume and MCV was significantly higher among men

compared to women (14.2 ± 2.0, 44± 4.0 and 85±10) versus (12.35±2.5, 42±3.0 and 66±54) respectively (p=0.01). Table 2 show mean values haematological parameters based on gender. Haemoglobin, packed cell volume and MCV was higher among civil servants compared to farmers (13.2 ± 2.9, 43.8±2.5 and 92.5 ± 32 compared to 12.5 ± 21, 43.8±2.5 and 78.02 ± 49.10) and students (13.21±2.5, 42±2.5 and 87.8 ± 50.5) (p=0.03). Table 3 show the mean values haematological parameters based on occupational group.

Table 1. *Mean values haematological parameters based on donor type.*

Haematological Parameter	Donor Type		P-value
	FRD (N=148) Mean ± SD	VND (N=2) Mean ± SD	
Hb (g/dl)	13.5±1.2	13.8±1.69	
HCT (%)	43.5±2.0	45±3.0	
MCH (Pg)	28±4.0	27±3.8	>0.05
MCHC(g/dl)	30±6.2	30±4.2	
MCV(fl)	60±35	60±35	

Hb = Haemoglobin
PCV =Packed Cell Volume
MCH=Mean cell Haemoglobin
MCHC=Mean cell Haemoglobin concentration
MCV=Mean cell volume
VND=Voluntary Non-remunerated Donor
FRD=Family Replacement Donors
N= Number tested

Table 2. *Mean values of haematological parameters based on gender.*

Haematological Parameter	Gender		P-value
	WN (N=5) Mean ± SD	MN(N=145) Mean ± SD	
Hb (g/dl)	12.35±2.5	14.2±2.0	0.01
HCT (%)	42±3.0	44±4.0	0.01
MCH (Pg)	26±3.7	27±3.5	>0.05
MCHC(g/dl)	30±3.2	29±4.9	>0.05
MCV(fl)	66±54	85±10	0.01

Legend
Hb = Haemoglobin
PCV =Packed Cell Volume
MCH=Mean cell Haemoglobin
MCHC=Mean cell Haemoglobin concentration
MCV=Mean cell volume
WM=Women
MN=Men
N= Number tested

Table 3. *Mean values of haematological parameters based on occupational group*

Haematological Parameter	Occupation			P-value
	FAR (n=65) Mean ± SD	C/C (n=56) Mean ± SD	STD (n=29) Mean ± SD	
Hb (g/dl)	12.5±2.1	13.3±2.9	13.21±2.5	>0.05
PCV (%)	41.5±4.0	43.8±2.5	42±2.5	>0.05
MCH (Pg)	27±3.0	27±3.1	27±3.05	>0.05
MCHC(g/dl)	30±4.8	30±4.9	29±2.8	>0.05
MCV(fl)	78.02±49.10	92.51±36	87.8±50.5	0.01

Legend
Hb = Haemoglobin
PCV =Packed Cell Volume
MCH=Mean cell Haemoglobin
MCHC=Mean cell Haemoglobin concentration
MCV=Mean cell volume
FAR=Farmers
C/C=Civil servants
STD=Students
n=number of subject(s)

4. Discussion

In this present study to investigated the prevalence of anaemia among blood donors in Sokoto, North Western Nigeria and observed a prevalence of anaemia (haemoglobin <11.0 g/dL) of 16%. Our finding is consistent with a previous report in Port Harcourt by Jeremiah and Koate which observed a prevalence of 13.7% among their cohort of blood donors [5]. Our finding is also consistent with a previous in India which indicated that 15.5% of blood donors were deferred due to anaemia [14]. Approximately 10% of American blood donors are not allowed to donate blood because of anaemia (Hb <12.5 g/dL) [15-16]. Previous report indicates that donations lost because of low haemoglobin deferral are multiplied because, once deferred, many donors do not return even if they previously were regular donors [17]. It has been estimated that donors deferred for low hemoglobin donate approximately 30% less blood over the following 4- to 5-year period than would have been donated had they not been deferred [18]. These individuals represent a large base of willing donors. The loss of their donations has a large cost implication on blood centers because of the time dedicated to recruiting and interviewing the potential donors as well as performing the haemoglobin or haematocrit testing. Nutritional anaemia is a worldwide problem with the highest prevalence in developing countries [19]. There are several reasons for the high prevalence of anaemia among blood donors in Sokoto, Nigeria. Socioeconomic factors, nutritional deficiency, acute blood loss, chronic diseases, high incidence of malaria, hookworm, HIV and other helminthic infections prevalent in the area can exacerbate the prevalence of anaemia. However, a previous report suggests that socioeconomic and nutritional factors have relatively little impact on low haemoglobin deferral among blood donors in a developed country such as the United States [15]. Socioeconomic status may also affect the risk of anaemia by affecting nutritional status, family size, and birth interval, as well as intensifying problems of affordability and accessibility to preventive and curative measures [20-21].

In this study we observed significantly higher haemoglobin, packed cell volume and MCV among male blood donors compared to female donors. Anaemia is a significant problem among women compared to men [22]. Our finding is consistent with a previous report from a multicenter study carried out in several American States which reported alarming levels of iron deficiency among

repeat donors; two thirds (66%) of women and almost half (49%) of men were iron deficient [14]. Previous report by Shalini and colleagues [6] indicated that anaemia is significantly higher in female donors compared to male donors. A previous report had queried why women should have lower reference limits for haemoglobin [23]. In pre-pubertal humans no major differences can be found between the sexes in red blood cell count or haemoglobin. Only after the onset of menstruation does a difference emerge [24]**.** Not until 10 years after the menopause does this situation revert in women, when the haemoglobin concentration becomes similar to that of aged- matched men. Menstruation is the principal cause of anaemia in women [25]. Furthermore, a significant number of females of childbearing age do not achieve the recommended daily intake of elemental iron (14.8 mg) from their diet [26]. Evaluation of the haemoglobin concentration and red blood cell count of women from Canada, Central America, China, and the United States shows that this situation is widespread. The case of African women is further exacerbated by high prevalence of malnutrition, malaria, HIV, haemoglobinopathies and helminthiasis [8, 27-29].

In this study we used haemoglobin cut-off of 11g/dl rather than 12g/dl commonly used as cut-off haemoglobin for anaemia among Caucasians. Evidence from other studies have shown that haematological indices are significantly lower in populations of African origin as compared to standard reference values quoted in the literature for industrialized countries, often applicable to Caucasians [30]. This difference could be due to dietary, environmental or genetic factors or a combination of several factors. Some of the factors implicated are a lower dietary intake of nutrients (iron, folate and vitamin B12), chronic blood loss due to parasitic infestation (hookworm) or recurrent plasmodium infection.

5. Conclusion

Anaemia is prevalent among blood donors in Sokoto, North Western, Nigeria. There is need to review the screening tests for the selection of blood donors and include haemoglobin measurement in the donor screening menu as well as provide iron supplementation for regular blood donors.

Conflict of Interest

The authors declare that there is no conflict of interest with this study.

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